Appendix D

Data Quality Objectives

Table 4-1. OU 3-14 Tank Farm soil DQOs.

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries
Background: The Tank Farm soil has become contaminated by spills and pipeline leaks of radioactive liquids from plant and transfer operations. In addition to the known highly contaminated areas, low levels of contamination exist at varying locations and depths. Limited knowledge of the extent (both vertically and horizontally) of contamination, volume of spilled material, types of contaminants, and contamination levels is available because many of the spill sites are in operational and highly radioactive sites. The principal threats posed by contaminated Tank Farm soil is external exposure to radiation and leaching and transport of contaminants to the perched water SRPA where future groundwater users could consume contaminated SRPA groundwater. The Tank Farm soil are defined as the soil that exist from the surface down to the uppermost basalt flow and include release sites in OU 3-06, 3-07, 3-08, and 3-11. These sites are located within the Tank Farm boundary (Sites CPP-15, CPP -16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP -30, CPP-31, CPP-32, CPP-33, CPP-58, and CPP–79), cumulatively known as Site CPP-96. Contaminants of potential concern (OU 3-13 COPCs) evaluated in the OU 3-13 ROD or in the OU 3-13 RD/RA include: Am-241,Ce-144, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Np-237, Pu-238, Pu-239/240 , Pu-241, Pu-242, Ru-106, Sr-90, tritium, Tc-99, U-234, U-235, U-236, and zirconium. Known non-radionuclide contaminants include As, Cr, Hg (mercuric nitrate), nitrate (nitric acid), and thallium. The OU 3-13 ROD showed that Cs-137, Sr-90, and U-235 were a risk to human health. Volatile organic compounds and SVOCs were identified as COPCs for release Site CPP-15 during previous OU 3-08 Track 2 investigations (WINCO 1993b), but were screened out as not being a risk concern. Given the type of sampling technique being implemented for Phase I Characterization, it is not possible to sample for VOCs and SVOCs at CPP-15 in Phase I. The concern for VOC and SVOC contamination will be addressed as part of the Phase II Characterization Work Plan. A final CERCLA remedy for the Tank Farm soil release sites has been deferred pending further characterization and coordination of any proposed remedial actions with the Idaho HLW & FD EIS and RCRA closure of the tanks. A separate RI/FS, Proposed Plan, and ROD will be prepared for the Tank Farm soil under OU 3-14. Interim actions were evaluated under the OU 3-13 ROD to provide protection until a final remedy is developed and implemented. The DOE-ID, EPA, and the IDHW have determined that the OU 3-13 interim action will be protective of human health and the environment while the WAG 3 OU3-14 RI/FS is being performed and a final remedy is selected (DOE-ID 1999b). For convenience and to facilitate the Tank Farm soil investigations, the soil have been divided into three sections: 0 to 3 m (0 to 10 ft bgs), 3 to 13.7 m (10 to 45 ft bgs), and 0 to 13.7 m (0 to 45 ft bgs). The purpose for the divisions are described below. .3 m (0 to 10 ft bgs)—includes the Tank Farm soil near the surface that can reasonably be remediated 3 to 13.7 m (10 to 45 ft bgs)—these are the Tank Farm soil that may not be feasible to remediate due to underground tanks and pipes and high radiation levels 3–13.7 m (0 to 45 ft bgs)—these are the soil from which the total Tank Farm source will be determined. Because the Tank Farm is an operational facility, future leaks and spills are possible.	Success at meeting the remedial action objective will be determined by obtaining sufficient characterization data to develop a RI/FS, proposed plan, and ROD from which a remedial action can be selected that will prevent contaminants in the Tank Farm soil from being leached down to the perched water and possibly contaminating the SRPA.				This study focuses on sufficiently characterizing the Tank Farm soil to understand the contamination types, levels, and distribution and the risks associated with the contamination, the areal hydrology, and the geochemistry for the purpose of identifying effective remedial actions for the OU3-14 RI/FS, proposed plan, and ROD. Specifically included in this study is the contamination in the surface soil (from the surface to top of basalt) at the Tank Farm. The physical boundaries of the study are the Tank Farm area known as Site CPP-96. Site CPP-96 includes CPP-15, CPP-16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP-30, CPP-31, CPP-32, CPP-33, CPP-58 and CPP–79. These are all the sites within the Tank Farm or adjacent to the PEW evaporator building. The boundary is defined in the OU 3-14 Scope of Work (DOE-ID 1999a). At depth, the boundaries of the study area are from the surface to the top of basalt. This depth varies with location but averages about 13.7 m (45 ft). OU 3-14 Characterization Investigation activities: • Field Investigation Phase I • Field Investigation Phase II • Contaminant Transport and Treatability Studies • Risk Assessment and Groundwater Modeling • RI/FS Report • OU 3-14 ROD Preparation The Post-ROD OU 3-14 Tank Farm remedial activities are anticipated to be undertaken in four stages timed to accommodate facility RCRA closure. Boundaries on the stages are shown below. • Stage I: Moisture monitoring and control • Stage II: Address immediate threats during Tank Farm operations and RCRA closure of some high level waste tanks • Stage III: Begin remediation of post-RCRA closure of the high level waste tanks but before D&D&D of the surrounding area and buildings • Stage IV: Final remedy for the Tank Farm area after all INTEC D&D&D activities are complete. Site characterization is anticipated to be initiated in two phases. In addition to the physical and time boundaries, shown above, other boundaries (listed below) could possibly impact the project. *Schedule boundaries*: The schedule may be impacted by the budget allotted for the remedial action. Any loss in the budget without adjustment in scope will extend the schedule. That action may adversely impact the mitigation of the transport of contaminants to the SRPA. *Budget boundaries:* The budget is anticipated to remain at a constant funding level during the course of the investigation. This will require that remedial actions be optimized not only technically but also financially.
	Principal Study Questions	Alternative Actions	Decision Statement		
	PSQ-1a: What is the number and spatial extent of the high contamination zones in the 0 to 3 m (0 to 10-ft) depth range? (This is required for evaluation of the residential and external risk and possible remedial alternatives.)	A: High-resolution data that are needed for evaluation of the external risk and remedial alternatives are available and sufficient to identify affected soil, soil volumes, and concentration levels of contaminated soil for major release sites in the 0 to 10-ft depth at the Tank Farm. Proceed with data collection. (No consequence is associated with this alternative.) B: Insufficient data or data without high resolution are available and add uncertainty to the identification and quantification of the major Tank Farm high-contamination areas. Proceed with gathering more information to make decision. (The consequence of this alternative is that additional information will be required in order to evaluate remedial technology.)	DS-1a: Determine whether the field screening methods have successfully identified all high contamination sites (16 to 23 pCi/g for Cs-137) in the Tank Farm soil 0 to 3 m (0 to 10 ft bgs) with a volume of ≤ 70 ft^3 of soil surrounding the probe hole. This information drives the evaluation of remedial technology and design.	Inputs to the PSQ-1a decision include: Historical records Process knowledge Gamma survey data Neutron survey data Nuclear constants Ratio estimation Soil analytical results	
	PSQ-1b: What is the number and spatial extent of the high contamination zones in the 0 to 13.7 m (0 to 45-ft) depth range? (This is required for the evaluation of groundwater risk and possible remedial alternatives.)	A: High resolution data that are needed for evaluation of the external risk and remedial alternatives are available and sufficient to identify affected soil, soil volumes, waste types, and concentration levels of contaminated soil for major release sites in the 0 to 45 ft depths at the Tank Farm. Calculate a source term for the Tank Farm soil. Proceed with further characterization. (No consequence is associated with this alternative.) B: Insufficient data or data without high resolution are available and add uncertainty to the identification and quantification of the major Tank Farm high contamination areas. Conduct additional data collection. (The consequence of this alternative is that additional information will be required in order to evaluate remedial technology.)	DS-1b: Determine whether the field-screening methods have successfully identified all high-contamination sites (16 to 23 pCi/g for Cs-137) from 0 to 13.7 m (0 to 45 ft bgs) in the Tank Farm soil with a volume ≤ 70 ft^3 of soil surrounding the probe hole. This information drives the evaluation of remedial technology and design.	Inputs to the PSQ-1b decision include: Historical records Process knowledge Gamma survey data Neutron survey data Nuclear constants Ratio estimation Soil analytical results	
	PSQ-2a: What are the radionuclide contaminants in each of the high contamination zones (from 0 to 13.7 m [0 to 45 ft bgs])?	A: The contaminants currently identified are the only radionuclides that are present in the Tank Farm soil that are above risk based action levels (OU 3-13 COPCs) and are a potential threat to the SRPA. Proceed with remedial investigation. (No consequence is associated with this alternative.) B: Other radionuclide contamination, in addition to the OU 3-13 COPCs, are present that are above risk based action levels and could potentially pose a threat to the SRPA. Evaluate all OU 3-14 COPCs to determine contaminated soil volumes, waste types, Tank Farm soil source term, etc. and to determine the appropriate remedial actions. (The consequence of this alternative is that all of the OU 3-14 COPCs need to be identified in order for remedial actions to address them.)	DS-2a: Determine whether additional radionuclides in either the soil or soil-pore water are present at concentration levels greater than risk action levels. If so, they will become OU 3-14 COPCs.	Inputs to the PSQ-2a decision include Historical records Soil analytical data Soil-pore water analytical data Field screening data Risk analysis results Model predictions Hydraulic properties K_d data	
	PSQ-2b: Are there non-radionuclide contaminants present in the Tank Farm soil from 0 to 45 ft bgs (in addition to those currently identified)?	A: Mercury, chromium, arsenic, thallium, and nitrates are the only non-radionuclide contaminants in the Tank Farm soil that are above risk based action levels and are identified as OU 3-14 COPCs. Proceed with remedial investigation. (No consequence is associated with this alternative.) B: Data suggests that other non-radioactive contaminants may become OU 3-14 COPCs. Evaluate all OU 3-14 COPCs to determine contaminated soil volumes, waste types, Tank Farm soil source term, etc. and for appropriate remedial actions. (The consequence of this alternative is that all of the OU 3-14 COPCs need to be identified in order for remedial actions to address them.)	DS-2b: Determine whether additional non-radionuclide contaminants are identified in concentrations above risk-based action levels. If so, they will be added to the OU 3-14 COPC list for the Tank Farm soil.	Inputs to the PSQ-2b include Historical records Process knowledge Soil analytical data Soil-pore water analytical data Field screening data Risk analysis results Model predictions Hydraulic properties K_d data	
	PSQ-3: What is the extent of the mobility of each of the contaminants within each of the identified soil matrices??	A: Contaminants are strongly sorbed to the Tank Farm soil. Proceed with remedial investigation. (No consequence.) B: Contaminants are mobile and are being or potentially can be leached out of the Tank Farm soil. Evaluate the threat and possible need of immediate and appropriate remedial actions. (The consequence is that immediate remediation may be required.)	DS-3: Determine whether contaminants are being transported out of the Tank Farm soil.	Inputs to the PSQ-3 decision include: Analytical concentration data Selected soil extractions (leach and absorption studies) K_d data Site-specific geochemistry Model predictions Hydraulic properties	
	PSQ-4a: What is the vertical moisture flux moving from the Tank Farm soil into the basalt?	A: Moisture data indicate there is insignificant flux through the Tank Farm soil to transport contaminants into the basalt, into the perched water and potentially to the SRPA. Proceed with remedial investigation. (No consequence is associated with this alternative.) B: Moisture data indicate that there is enough flux moving through the Tank Farm to transport contaminants to the perched water and potentially to the SRPA. Evaluate for possible Stage II actions. (The consequence is that if there is significant OU 3-14 COPC flux, immediate remediation may be required.).	DS-4a: Determine whether the flux out of the soil is stopped by the interim actions. (An additional benefit of moisture characterization may be the identification of major recharge sources.)	Inputs to the PSQ-4a decision include: Moisture data Matric potential data Contaminant concentrations Model predictions Hydraulic property data Recharge sources	
	PSQ-4b: What is the horizontal moisture flux into the Tank Farm soil?	A: Data indicate there is little moisture moving into the Tank Farm soil horizontally. Proceed with remedial investigation. (No consequence is associated with this alternative.) B: Moisture data indicates that a significant lateral flux exists in the Tank Farm soil. Evaluate for possible Stage II actions and proceed with investigation. (The consequence is that if moisture is moving laterally, immediate remedial actions may be required and lateral flux will be a necessary consideration for long-term remedial actions.).	DS-4b: Determine whether moisture is moving into the Tank Farm soil (under the temporary cover) from areas outside the Tank Farm.	Inputs to the PSQ-4b decision include: Moisture data Matric potential data Contaminant concentration data Model predictions Hydraulic property data Recharge source K_d data	

Table 4-1. (continued).

1: State the Problem	2: Identify the Decision		3: Identify Inputs to the Decision	4: Define the Study Boundaries
Problem Statement: The Tank Farm soil is known to be contaminated from historical spills and releases. Information from previous investigations about the nature and extent of the Tank Farm soil contamination is incomplete. The size, location, contaminant type, dose rate, source term, and OU 3-14 COPC (OU 3-14 Remedial Investigation determination) migration probability from the site need to be clarified for future remedial actions. The moisture content, contaminant flux out of the Tank Farm soil, and physical, hydraulic, and geochemical soil parameters are required.	PSQ-5 Based upon new data obtained during evaluation of the Tank Farm high contamination zones and soil moisture, what are the best final remedial approaches?	A: Data are sufficient to characterize the Tank Farm soil, write a RI/FS, and develop appropriate remedial alternatives. Proceed with remedial technology evaluation. (No consequence.) B: There is still too much uncertainty to develop an RI/FS or suggest appropriate remedial actions. Conduct further investigations until understanding is sufficient to recommend appropriate remedial technology. (The consequence is that more data will be required.)	DS-5: The recommended remedial action will be based on hydraulic, geochemical, and physical drivers; the success of the interim actions; and the comparison of the identified requirements, associated technologies, and their cost.	Inputs to the PSQ-5 decision include: Final OU 3-14 Tank Farm soil COPC list Concentration levels Contaminant flux Number of high contamination zones Waste volume Tank heels Recharge water/sources Site-specific geochemistry data Deep drainage Hydraulic properties Model predictions Waste types (TRU, RCRA, characteristic, TSCA, mixed, etc.) Remedial cost Impracticability of technology Technical feasibility of remediation technology Maturity of technology Efficacy of technology Source term for Tank Farm soil Source term for Tank Farm soil and closed tanks	*Moisture boundaries:* Moisture boundaries with the potential to impact the OU 3-14 investigation and remediation are only on the high side. Saturated moisture conditions mandate immediate action. The soil cannot become too dry. *Concentration boundaries:* These boundaries result from contaminant concentrations. For radionuclide concentrations the boundaries extend from low concentrations to the risk-based action levels agreed to in the OU 3-13 ROD. A high dose rate could drive remote remedial methods. Other remedial considerations related to concentration levels include upper inventory levels of possible waste disposal facilities. Metals concentration levels should not impact remedial activities. Should high VOC levels be present, some remedial activities could be affected, e.g., grout and thermal processes. *Operational boundaries:* The remediation of the Tank Farm soil will occur in stages (shown above) to cooperate and not interfere with operational activities. Activities in each stage of remediation could be impacted by ongoing operations. *Treatment evaluation boundaries:* The evaluation of remedial technologies may potentially be impacted by a variety of laboratory-related influences including scale, contamination levels, and heterogeneity. It may also be impacted by the implementability of the treatment. *Integration boundaries:* Final remediation may be impacted by the integration of any or all of the above boundaries.

Table 4-1. (continued).

5: Develop a Decision Rule	6: Specify Tolerable Limits on Decision Errors	7: Optimize the Design
DR-1a: If high resolution data are available and sufficient to identify affected soil, soil volumes, and concentration levels of contaminated soil for all major release sites in the 0 to 3 m (0 to 10-ft) depths at the Tank Farm then proceed with Alternative A. If not, proceed with Alternative B.	Data collected to determine whether additional contaminants in the Tank Farm soil are at concentration levels equal to or greater than risk-based action levels (DS-2a and DS-2b) are amenable to statistically based limits on decision errors. Hypothesis testing will be utilized to determine if action levels are exceeded to resolve Principal Study Questions 2a and 2b (PSQ-2a and PSQ-2b). The null hypothesis, H_0, is that the true mean of a contaminant is greater than or equal to the risk-based action level. The alternative is that the true mean is less than the risk-based action level. H_0: $\mu \geq$ action level H_a: $\mu <$ action level The hypothesis testing will be performed to a level of significance, α, of 0.05. In other words, with this level of significance, we limit the probability of a Type I error, or of rejecting the null hypothesis when it is true, to 5%. The hypothesis testing is designed to allow us to control the probability or erroneously concluding that action levels are not exceeded when in fact they are exceeded. The null hypothesis was formulated based upon the belief that the harmful consequences of incorrectly concluding that an action level is not exceeded when it actually is exceeded outweigh the consequences of incorrectly concluding that the action level is exceeded when in fact it is not. Statistically based decision errors are not appropriate for the other decision statements.	The information necessary to evaluate remedial alternatives and develop the feasibility study will be obtained from the site characterization and, if deemed necessary, treatability and contaminant transport studies. A final decision will be made in the OU 3-14 ROD. It is envisioned that four stages of Post-OU 3-14 ROD remedial activities will occur. Stage I. Activities included in Stage I will focus on moisture monitoring and control. It is during this stage that the Phase I characterization activities will occur, in addition to the OU 3-13 Tank Farm Interim Action. Phase I activities include: the surface geophysics/gamma surveys, installation of the probeholes, gamma logging of the probeholes, and direct sampling of selected vacuumed soil stored in drums from the probehole installation activities. Technical papers to be prepared during Phase I include: Phase I data summary report and a remedial alternative screening report. Stage II. During Stage II immediate threats during Tank Farm operations and RCRA closure of some high level waste tanks will be addressed. During this stage, Phase II characterization will be implemented, along with continuing the OU 3-13 Tank Farm Interim Action. Phase II involves conducting a more detailed soil gamma survey, and potentially collecting soil samples from specific areas, i.e., hot spots, to characterize contaminants, waste types, and source terms. This would involve the installation of large-diameter probe holes and moisture monitoring stations, initiation of moisture monitoring, and contaminant mobility studies. If deemed necessary, treatability studies may also be initiated during this phase, which would evaluate in situ stabilization, grouting, and other technologies that are under consideration. Technical papers to be prepared during Phase II include: Phase II data summary report, contaminant transport study report, risk assessment strategy, groundwater strategy, conceptual model report, RI/BRA report, treatability study report (if treatability studies are performed), and a feasibility study report. Stage III. During Stage III, remediation of post-RCRA closure of the high-level waste-tanks will began, in addition to continuing the OU 3-13 Tank Farm Interim Action. This stage will occur before D&D&D of the surrounding area and buildings. Stage IV. Activities in Stage IV include the final remedy (compatible with the OU 3-13 Tank Farm Interim Action) for the Tank Farm area after all INTEC D&D&D activities are complete.
DR-1b: If high resolution data are available and sufficient to identify affected soil, soil volumes, waste types, and concentration levels of contaminated soil for major release sites in the 0 to 13.7 m (0 to 45-ft) depths at Tank Farm, proceed with Alternative A. If not, proceed with Alternative B.		
DR-2a: If contaminants currently identified are the only radionuclides that are present in the Tank Farm soil that are above risk based action levels and are a potential threat to the SRPA, proceed with Alternative A. Otherwise proceed with Alternative B.		
DR-2b: If Hg, Cr, As, and nitrates are the only non-radionculide contaminants in the Tank Farm soil that are above risk based action levels and are identified as OU 3-14 COPCs, then proceed with Alternative A. Otherwise, proceed with Alternative B.		
DR-3: If contaminants are strongly sorbed to the Tank Farm soil, then proceed with Alternative A. Otherwise, proceed with Alternative B.		
DR-4a: If moisture data indicate there is insignificant flux through the Tank Farm soil to transport contaminants down to the perched water and potentially to the SRPA, then proceed with Alternative A. Otherwise, proceed with Alternative B.		
DR-4b: If data indicates there is not significant moisture moving into the Tank Farm soil laterally, then proceed with Alternative A. Otherwise, proceed with Alternative B.		
DR-5: If there is enough data to characterize the Tank Farm soil, write a RI/FS, and develop appropriate remedial alternatives, then proceed with Alternative A. Otherwise, proceed with Alternative B.		